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NOTES AND DESCRIPTIONS OF NORTH AMERICAN SERPHIDÆ. (HYMENOPTERA.)¹

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The family Serphidæ, long familiar to entomologists as the Proctotrypidæ, includes a considerable number of very closely related species from many parts of the world. The group is well represented in the Nearctic region from whence numerous species have already been described. In going over material which has accumulated during a number of years, I have found a few undescribed forms which are described in the present paper.

The first North American species were early described by Say; a couple were added much later by Provancher, but the family received no serious attention at the hands of American entomologists till 1893 when Ashmead² published descriptions of all the known North American species. He included twenty-one species, all under the name *Proctotrupes* and considered the group as a subfamily. Since that time a number of species have been added, including some species of the genus *Disogmus* hitherto known only from Europe. Quite recently Kieffer³ has subdivided the old *Proctotrypes* into four

¹ Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 128.

² Monograph of the North American Proctotrypidæ, Bull. U. S. Nat. Museum, No. 45.

³ Ern. André, Spéc. Hym. Europe et Algérie, vol. 10 (1908), and Gen. Insect., Fasc. 95 (1909).

genera, *Serphus* (= *Proctotrypes*), *Cryptoserphus*, *Phænoserphus* and *Exallonyx*.⁴ In the Genera Insectorum he has distributed the North American species in these genera, but has made a few errors owing to lack of North American material. Some of these I have been able to correct, although I have not been able to place definitely several species which I have not seen. In the genera *Serphus* and *Exallonyx* in addition to the descriptions of new species, I have appended keys for the separation of the Nearctic forms with the omission of a few that could not be located generically.

Many of the new species are from the far West, received from time to time from Professor A. L. Melander, who collected them mainly in Washington. From our present knowledge, it would appear that the family is better represented on the Pacific slope than in the eastern United States, although it is evident that the forms in the East are as yet far from all known.

The figures were all drawn by Mrs. C. T. Brues from camera lucida pencil sketches.

Serphus Schrank.

KEY TO NORTH AMERICAN SPECIES.

1. Petiole of abdomen twice as long as thick; abdomen rufous except at tip.
melliventris Ashm.
- Petiole of abdomen not longer than thick, usually shorter 2
2. Antennal joints long, third joint over four times as long as thick 3
Antennal joints shorter, the third only three times as long as thick; body
black **nevadensis** Kieff.
3. Head, and also most of the rest of the body, ferruginous or rufous... 4
Head and thorax black, abdomen often rufous in considerable part ... 5
4. Rugosities of propodeum forming distinct longitudinal lines medially and
basally, no distinct median longitudinal carina; propodeum black or
piceous **caudatus** Say.
Propodeum irregularly rugose, but with a distinct median carina body en-
tirely rufous or fulvous **pallidus** Say.
5. Propleura with a large, smooth, shining area above the middle, irregularly
striate elsewhere 6
Propleura without a large, smooth area; its entire surface irregularly
striate or sculptured **zabriskiei** sp. nov.
6. Propodeum irregularly rugose, with at most a median carina 7
Propodeum with the rugosities forming a series of longitudinal lines; pro-
podeum long and gradually sloping; abdomen and most of legs reddish.
longiusculus Brues.

⁴ First described in Bull. Soc. Hist. Nat. Metz, vol. 11, p. 34 (1904).

7. Abdomen, except base and apex, ferruginous or bright rufous; legs yellow
or honey yellow 8
Abdomen black or sometimes partly dull rufous, legs strongly infuscated.. 10
8. Radial cell very short, not longer than the width of the radial vein.
linellii Ashm.
Radial cell at least one third as long as the stigma 9
9. Propodeum without any trace of a median longitudinal carina, gradually
sloping behind *rufigaster* Prov.
Propodeum with a median carina distinct at least at the base.
terminalis Ashm.
10. Propleura with a broad, convexly raised longitudinal band extending along
its upper portion, separated from the upper edge by a striated groove;
abdomen brownish at the base *sequoiarum* sp. nov.
Propleura flat or concave, without a raised band 11
11. Abdominal petiole as broad as long; black with legs, except tibiae and
tarsi, piceous *cockerelli* sp. nov.
Abdominal petiole transverse, much shorter than broad 12
12. Malar furrow present *florissantensis* Rohwer.
No malar furrow *debilis* sp. nov.

***Serphus zabriskiei* new species. (Fig. 1.)**

♀. Length 6 mm. (exclusive of ovipositor). Black, abdomen ferruginous beyond the petiole; legs fulvo-ferruginous, four posterior coxæ piceous, lighter at tips, tegulæ fuscous; antennæ brown at extreme base. Head slightly more than twice as wide as thick; malar space slightly longer than the width of the mandibles at base, with a distinct furrow; clypeus broad, its anterior margin convex, its surface densely punctate. Eyes bare. Antennæ very slender; scape twice as long as thick, flagellar joints gradually shortened after the first, which is over five times as long as thick; penultimate joint three times as long as thick. Pronotum one-third as long as the mesonotum, transversely striate in front of the constriction; distinctly trilobed behind. Propleura obliquely striate on its lower half, irregularly longitudinally striate above, without the large, smooth space that is usually present. Mesopleura with a series of longitudinal striæ on its upper half in front of the convex portion, behind with a series of crenate punctures along the edge, which extend forward to form grooves on the posterior third of the lower half of the mesopleura. Propodeum coarsely rugose-reticulate, without areas or any trace of any longitudinal carina. Abdominal petiole quadrate, about as wide as long; second segment at base above with grooves as long as the petiole; ovipositor two thirds as long as the remainder of the abdomen, straight except at the tip, which is strongly curved downward. Legs slender, tarsal claws simple; longer spur of hind tibiae one third as long as the metatarsus, the latter as long as the two following joints together. Wings tinged with brownish; radial cell very short, not longer than the width of the radial vein, the latter distinctly prolonged downward and surrounded by a small brown clouded area; discoidal vein indicated as a fuscous streak.

Described from a specimen collected by J. L. Zabriskie at Rochester, N. Y., June 10, 1905. Type in the American Museum of Natural History.

This species may be distinguished from other members of the genus of similar color by the sculpture of the propleura and propodeum and the form of the abdominal petiole.

Serphus sequoiarum new species. (Fig. 2.)

♂. Length 4.5 mm. Black; second abdominal segment, except apex, rufous-ferruginous; legs yellowish brown, anterior femora, tibiae and tarsi and middle tibiae light yellow, hind tibiae somewhat paler than their femora. Head two and one half times as broad as long, malar space as long as the width of the mandibles at base, with a distinct furrow. Clypeus broad, sparsely punctate, its anterior margin straight. Eyes bare. Antennal scape one half longer than thick; first flagellar joint twice as long as the scape, nearly five times as long as thick at apex; following joints decreasing very gradually in length, the penultimate over four times as long as thick and two thirds as long as the first; pronotum less than one third as long as the mesonotum, transversely striate in front of the constriction, trilobed behind. Parapsidal furrows indistinctly defined, but more prominent than usual. Propleura irregularly striate-reticulate anteriorly, smooth behind; its upper portion with a convexly raised band which is separated from the upper edge by a shallow groove or depression that is longitudinally striated and narrower than the elevated portion; the anterior end of the elevation forms the lateral lobe of the pronotum. Mesopleura longitudinally striated above in front of the raised portion and with a series of large punctures inside the posterior edge above the middle; below the middle these are elongated to form short horizontal striae. Propodeum rugose-reticulate, with a complete median longitudinal carina, but without areas. Abdominal petiole as long as broad; grooves at base of second segment shorter than the petiole. Legs slender; longer spur of hind tibia one third the length of the metatarsus; tarsal claws simple. Wings very slightly tinged with brownish, radial cell very short, but longer than the width of the radial vein; both sections of this vein prolonged downward as brown streaks, the basal streak longer; cubital and discoidal veins indicated as brown streaks.

One specimen collected by Prof. A. L. Melander in the Muir Woods, Marin Co., California.

This species is easily recognizable by the peculiar conformation of the propleura and the conspicuously lighter color of the front legs and middle tibiae.

Serphus cockerelli new species. (Fig. 3.)

♂. Length 5 mm. Black; four anterior coxae and all trochanters and femora piceous; tegulae, tibiae and tarsi yellowish brown. Head somewhat

more than twice as broad as thick. Clypeus higher and less strongly narrowed below than usual, only twice as broad as high, anterior edge slightly arcuate, surface moderately punctate. Malar space longer than the width of the mandible at base, with a fine, distinct furrow. Antennæ slender; scape one half longer than thick; first four flagellar joints scarcely decreasing in length, each fully five times as long as thick; penultimate joint over four times as long as thick. Pronotum transversely striate in front of the constriction, trilobed behind, with the lateral lobes more prominent than the median one. Mesonotum with well marked vestiges of parapsidal furrows. Propleura irregularly and more or less obliquely striate on its lower anterior half; above with a series of five longitudinal striæ below the upper edge. Mesopleura striate between the raised portion and the tegulæ and anteriorly below; below with a series of punctures inside the edge and a small roughened area above the middle coxa. Propodeum coarsely rugose-reticulate, with a complete median raised line; long and very gradually sloping behind. Abdominal petiole as long as broad, roughly rugose, with a median channel above; striate-reticulate below; second segment with the grooves at base extremely short, shorter than the petiole. Legs long and slender; longer spur of hind tibia one third as long as the hind metatarsus; all tarsal claws simple. Wings faintly tinged with brownish; stigma moderately broad; radial cell nearly half as long as the stigma; both sections of the radial vein prolonged into the wing as brown streaks, each for a distance somewhat exceeding its own length; cubital and discoidal veins indicated as brownish streaks.

Type from Eldora, Colorado, August 18. Collected and sent me by Prof. T. D. A. Cockerell.

Serphus debilis new species. (Fig. 4.)

♂. Length 4 mm. Black; tegulæ, knees, front tibiæ and base and apex of four posterior tibiæ brownish yellow; abdomen beyond petiole dull rufous above, especially on the second segment. Head nearly two and one half times as long as thick; ocelli in a nearly equilateral triangle, the posterior ones much farther from the eye-margin than from one another. Malar space longer than the width of the mandible at base; no malar furrow; clypeus over three times as broad as high, its anterior margin nearly straight. Antennal scape twice as long as thick; flagellar joints gradually decreasing in length, the first nearly five times as long as thick; second somewhat stouter, four times as long as thick. Pronotum transversely striate before the constriction, lobed on each side behind; parapsidal furrows obsolete, but evident as slight depressions. Propodeum long, very gradually sloping behind, finely rugose, with a complete, but not strongly defined, median carina. Propleura finely longitudinally striate along its upper edge, below and in front irregularly rugulose-striate; mesopleura with a large, finely striated area below the tegulæ and a coarsely striated one in front below; punctures along hind margin prolonged as striæ on the lower half of the pleura; metapleura finely rugose throughout. Abdominal petiole transverse, seen from above less than

half as long as broad; striæ at base of second segment close together, as long as the width of the petiole. Legs long and slender; longer spur of hind tibia slightly more than one third the length of the metatarsus; tarsal claws simple, wings slightly tinged with brownish; radial cell short, about twice as long as the width of the radial vein; second section of the latter prolonged downward as a brown streak; cubital and discoidal veins visible as pale brown streaks.

One specimen, Wawai, Washington, May 20, 1911, A. L. Melander.

This species presents no striking characters, but as indicated in the key to species is distinct; it seems to come nearest to *S. florissantensis* Rohwer with a paratype of which I have been able to compare it.

Cryptoserphus Kieffer.

Kieffer⁵ does not place any North American species in this genus, but some undoubtedly belong here as they have the abdominal petiole very short. They do not all show all the other characters attributed to the genus, however, and it may be necessary later to unite *Cryptoserphus* with *Phanoserphus* as has already been suggested by Dodd.⁶

C. flavipes Provancher. Faun Ent. Canada, Hymén., p. 562 (1883) (*Proctotrupes*).

C. clypeatus Ashm. Bull. U. S. Nat. Mus., No. 45, p. 339 (1893). (*Proctotrupes*.)

C. abruptus Say.

Complete works, vol. 2, p. 725 (1836). (*Proctotrupes*.)

Ashmead, l. c., p. 339. (*Proctotrupes*).

C. obsoletus Say.

Complete works, vol. 2, p. 725 (1836). (*Proctotrupes*.)

Ashmead, t. c., p. 340. (*Proctotrupes*).

C. belfragei Ashm.

Bull. U. S. Nat. Mus., No. 45, p. 340 (1893). (*Proctotrupes*).

C. flavipes Prov. (Fig. 5.)

Cannot be recognized from his description. As identified by Ashmead, it is easily recognized by its long radial cell and is a *Cryptoserphus*. I have specimens from Woods Hole, Mass., and Black Rock Mt., Ga. (3,500 ft.). In the far West there is another similar species described as *occidentals* on a later page of the present paper.

⁵ Genera Insectorum, fasc. 95, p. 7 (1909).

⁶ Trans. R. Soc. South Australia, vol. 39, p. 387 (1915).

C. abruptus Say. (Fig. 6.)

Is also not recognizable from the original description. As redescribed by Ashmead it can be easily identified, although he does not mention the unusually stout legs. The longer spur of the hind tibia is claw-shaped, being distinctly bent and considerably thickened and the hind metatarsus is scarcely longer than the two following joints together.

C. obsoletus Say.

As identified and redescribed by Ashmead it is also a *Cryptoserphus*, and as Say's description will not locate the species definitely, should be accepted as fixing the species.

The two following species may be added:

Cryptoserphus occidentalis new species. (Fig. 7.)

♀. Length 3-4 mm. Black; legs, base of antennæ and abdomen between the third segment and ovipositor brownish yellow. Head slightly more than twice as broad as thick when viewed from above; strongly narrowed below the eyes when seen from the front, the malar space as long as the width of the eye, the width of the clypeus, malar furrow indicated as a small fovea next the eye; anterior margin of clypeus straight or slightly concave. Antennæ slender, moderately long; first flagellar joint five times as long as thick; second to fifth growing gradually shorter, each about four times as long as thick; following growing shorter more rapidly, the penultimate a little more than twice as long as thick. Eyes bare. Pronotum nearly half as long as the head, finely transversely striate before the constriction; humeral angle with a prominent, rounded swelling. Mesonotum with short foveiform parapsidal furrows just behind the humeri, but not indicated elsewhere. Propodeum white pubescent, with a median and pair of lateral carinæ on its basal half, defining two large, smooth areas; also with an ill-defined petiolar area on the rather gradually sloping posterior face, which is reticulate; sides with an indistinct lateral carina extending from the spiracle. Pro- and mesopleura entirely smooth; metapleura in the middle with a large shining area bordered below and behind by a raised margin; depressed, finely sculptured and pale pubescent elsewhere. Abdominal petiole very short, concealed above by the margin of the second segment; base of second segment with numerous basal striæ half as long as the posterior trochanter. Ovipositor slender, slightly curved apically, as long as the basal three joints of the posterior tarsus. Legs slender, longer spur of posterior tibia distinctly more than half as long as the metatarsus. Wings hyaline, stigma not very broad; radial cell as long as the stigma along the costal margin; other nervures not indicated by streaks.

Four specimens: type and one other from Chatcolet Lake, Idaho,

Aug., 1915, the other two from Tacoma, Wash., Aug. 28, 1911. All were collected and sent me by Prof. A. L. Melander.

This species is very similar to the eastern *C. flavipes* Prov. in wing venation and length of the tibial spur. It differs most strikingly in the form of the head which is narrowed and lengthened below the eyes, making the malar space longer.

Cryptoserphus melanderi new species. (Fig. 8.)

♂. Length 3 mm. Black, highly polished; legs beyond the trochanters yellow-brown. Head twice as wide as long when seen from above; face strongly convex medially, but without a vertical ridge-like protuberance below the antennæ; clypeal foveæ much more deeply impressed than usual, forming deep pits; clypeus short and broad, with nearly straight lower margin, bulging below the foveæ. Malar space short, with a finely impressed furrow as long as the width of the mandible at base; front with a vertical impression between the base of the antennæ and eye. Antennæ rather stout, conspicuously whitish pubescent. Scape very thick, one half longer than wide; first flagellar joint about four times as long as thick at apex; second a little shorter and stouter; third and following scarcely shorter, but becoming appreciably more slender. Eyes very sparsely pubescent. Pronotum transversely striate before the constriction; behind with the lateral angle produced as a conspicuous, almost acute tubercle. Mesonotum with the parapsidal furrows impressed close to the anterior margin, entirely absent elsewhere. Depression at base of scutellum deeply foveate at each side. Upper face of propodeum with two smooth areas dorsally, these narrowed behind owing to the oblique lateral carinæ; outside of these with a transversely rugose oblong area behind each spiracle; posterior surface somewhat concave and constricted, coarsely reticulate. Pro- and mesopleuræ smooth, the latter with a line of coarse punctures inside its posterior margin; metapleura reticulate, smooth in front above. Abdominal petiole not visible from above; base of second segment above with numerous, fine, parallel grooves nearly as long as the posterior trochanter. Wings hyaline, stigma and veins brown; stigma broad, triangular; radial cell along the costa two thirds as long as the stigma; second section of radius prolonged obliquely downward as a brown streak, cubital and discoidal veins indicated by barely visible brownish streaks. Legs rather stout; longer spur of hind tibia as long as the metatarsus.

Three specimens from Pullman, Wash., May 18, 1909, collected and sent me by my friend Prof. A. L. Melander, for whom the species is named.

This is a very distinct species, recognizable by the deep clypeal foveæ, stout, evenly jointed antennæ, sharply tuberculate prothorax and rather long radial cell.

Phænoserphus Kieffer.

The only North American species belonging to this genus which I have seen is the following:

Phænoserphus longipes new species. (Fig. 9.)

♂. Length 4.8 mm. Black; legs honey yellow; hind coxæ black; base of middle coxæ and middle and hind trochanters fuscous; antennal scape yellow below. Head slightly more than twice as broad as long, strongly narrowed behind the eyes; clypeus short and broad, only one fourth as high as its greatest width; malar space one and one half times as long as the width of mandible at base, no malar furrow. Antennæ moderately thick, with long joints clothed with short pubescence; scape stout, nearly cylindrical, twice as long as wide; first flagellar joint about four times as long as thick; following gradually decreasing in length and thickness, the penultimate two thirds as long as the first and three times as long as thick. Pronotum greatly constricted at the middle, transversely striated in front; its hind angles produced into a distinct rounded swelling. Mesonotum with faint traces of parapsidal furrows anteriorly. Metathorax coarsely rugose-reticulate, with a median carina on its superior face and a somewhat indistinct rounded petiolar area behind; on each side of the median carina is a smoother space bounded by indistinct carinæ, but these basal areas are not clearly defined. Pro- and mesopleuræ entirely smooth and shining, the latter with a series of large foveate punctures inside its posterior edge. Metapleuræ rugose, without any smooth space. Abdominal petiole twice as long as broad seen from above, longitudinally ribbed and transversely rugose between the ribs; second segment long, narrow basally, at base with striæ less than the length of the petiole. Legs long, but not very slender, tarsal claws simple; longer spur of hind tibiæ barely longer than one third the length of the metatarsus. Wings distinctly tinged with brownish; stigma and radial veins fuscous, the cell about half as long as the stigma; both sections of the radial vein extending into the wing as brownish streaks; radial and cubital veins prolonged as brownish streaks.

One specimen from Almota, Wash., June 24 (A. L. Melander).

Exallonyx Kieffer.

KEY TO NORTH AMERICAN SPECIES.

1. Antennal joints short; flagellum slightly thickened toward tip; penultimate joint quadrate or at least scarcely twice as wide as long; basal joints in male simple 2
- Antennal joints elongate, flagellum distinctly attenuated toward tip; penultimate joint about three times as long as thick; basal joints in male frequently with a tooth on the external margin 5
2. Head one and one half times as long as wide; eye removed from posterior margin of head by more than its greatest length. (Fig. 10.)

angusticeps Brues.

- Head but little longer than wide; eye removed from posterior margin of head by about its greatest length or less 3
3. Ovipositor longitudinally aciculate, penultimate joint of antennæ quadrate. 4
Ovipositor with scattered, elongate punctures; penultimate joint of antennæ twice as long as thick **similis** n. sp.
4. Antennæ pale at base; median stria at base of second abdominal segment much longer than the lateral ones **quadriceps** Ashm.
Antennæ black or piceous throughout; striæ of second abdominal segment nearly equal in length **femoratus** Ashm.
5. Males 6
Females 19
6. Some of the basal joints of antennæ with a linear process or tooth near the middle of the external side 7
All joints of antennæ simple, without any projections or processes ... 15
7. First flagellar joint simple, cylindrical, second and several following joints with a process, legs honey-yellow 8
First flagellar joint as well as some of the following ones with a process. 9
8. Antennal flagellum black, eighth joint with a small, but distinct process; larger, western species 6 mm. (Fig. 12.) **placidus** Brues.
Antennal flagellum brown, no process on eighth joint; smaller, eastern species **fuscinornis** n. sp.
9. Antennal flagellum black 10
Antennal flagellum yellow at base, fuscous apically, eastern species. **ashmeadi** n. sp.
10. Head decidedly less than twice as broad as thick when seen above ... 11
Head approximately twice as broad as long 14
11. Median carina of propodeum complete 12
Median carina of propodeum not extending to apex; processes on basal flagellum joints acute, dentiform **dentaticornis** Kieff.
12. Propodeum with a smooth space on each side of the median carina at base 13
Propodeum without smooth spaces **crenaticornis** Kieff.
13. First four flagellar joints with a process externally; fifth with a less distinct one **fallacicornis** Kieff.
First six flagellar joints with a process, seventh with a faint trace of one. **obscuripes** Brues.
14. Only the first five flagellar joints with a carinate process externally; malar furrow deeply impressed; mesopleura irregularly striate anteriorly. **pleuralis** n. sp.
Seven or eight flagellar joints toothed or with processes; mesopleura entirely smooth and polished. (Fig. 16.) **serricornis** Brues.
15. Head approximately twice as broad as long when seen from above ... 16
Head decidedly less than twice as broad as long, strongly narrowed behind the eyes 18
16. Petiole of abdomen long, twice as long as broad; antennæ yellow. **longiceps** Ashm.

- Petiole of abdomen not longer than broad 17
17. Propodeum strongly narrowed behind; antennæ not pale at base. (Fig. 17.)
simplicior Brues.
 Propodeum gradually narrower behind; antennæ pale yellow at base.
pallidicornis n. sp.
18. Propodeum with a strong carina, especially prominent at the apex of its horizontal face, with large, smooth areas basally **carinatus** n. sp.
 Propodeum with the median carina evident, but not strong; basal smooth areas not clearly defined; head strongly narrowed below toward the mouth **parvulus** n. sp.
19. Petiole smooth above and beneath **grandis** n. sp.
 Petiole longitudinally striate above and beneath **longiceps** Ashm. ♀.

E. canadensis and *E. simulans* Ashmead are not included in the above table. *E. californicus* Holmgren is also omitted, as I cannot identify it among the numerous forms from the west which have the flagellar joints dentate in the males. The form referred to this species by Ashmead⁷ is evidently not Holmgren's species and is, I believe, the one described on a later page as *E. ashmeadi* sp. nov.

Exallonyx similis new species. (Fig. 11.)

♀. Length 2.5-3 mm. Black; tegulæ, and legs and antennæ in part, yellow; antennæ brownish yellow at base, darkened beyond the middle and fuscous toward apex; legs brownish yellow, the femora above, and hind tibiæ toward apex, dark; middle and hind coxæ piceous, except at apex. Head about as long as broad, gradually constricted behind the eyes. Eyes sparsely pubescent, removed by slightly more than their width from the posterior margin of the head when seen from the side; malar space as long as the width of the eye, without furrow; anterior margin of clypeus straight. Antennæ reaching to base of abdomen; scape twice as long as thick, narrowed at base; first flagellar joint slender, three times as long as thick at apex; second, third and following each scarcely shorter than the preceding, but growing stouter; second two and one half times as long as thick; penultimate twice as long as thick. Mesonotum long and narrow, highly polished; groove at base of scutellum broad and shallow. Propodeum with long horizontal face, abruptly declivous behind; rugose-reticulate on the sides and behind; with a strong median carina above, on each side of which is a smooth space that extends to the top of the declivity. Pro- and mesopleuræ entirely smooth except for several striæ on the mesopleura below and in front of the upper raised portion; metapleura rugose below, shining on upper third. Petiole of abdomen a little longer than wide, rugose above, coarsely striate below; second segment angularly incised at base, with a median stria as long as the petiole and several short lateral striæ; ovipositor acutely pointed, but little curved, as long as the hind metatarsus, sparsely punctate. Legs rather slender, longer spur

⁷ Bull. U. S. Nat. Mus., No. 45, p. 338 (1893).

of hind tibia nearly one half as long as the metatarsus; claws of front and middle tarsi with a long appendage at base. Wings hyaline, without cubital or discoidal streaks; stigma light brown, not very broad, the radial cell short, its outer edge very oblique.

Type from Tacoma, Wash., August 28, 1911. Five other specimens from Burton, Wash.; Vashon, Wash.; Pullman, Wash.; and Berkeley, Cal., taken during June and August. All were collected and sent to me by Prof. A. L. Melander.

This species is similar to the eastern *E. quadriceps* Ashm., which it resembles very closely. It is at once separated by the absence of striæ on the ovipositor. From *E. femoratus* Ashm. it is easily distinguished as set forth in the key to species.

Exallonyx fuscicornis new species. (Fig. 13.)

♂. Length 3.5 mm. Black; tegulæ, palpi, scape of antennæ and legs brownish yellow; front and middle coxæ light brown; flagellum of antennæ fuscous; hind coxæ black. Head barely twice as broad as long, strongly narrowed behind; ocelli in a flat triangle, the hind ones farther from one another than from the eye-margin. Eyes removed from posterior margin of head by their own width, bare or nearly so; malar space as long as half the width of the eye, without furrow; head much narrowed below when seen from in front; margin of clypeus straight. Antennæ reaching to basal third of second abdominal segment; scape twice as long as thick; first flagellar joint simple, without process, not quite three times as long as thick and subequal to the second, third and fourth; following slightly shorter, subequal, becoming more slender; second to seventh joints each with a carina externally on the basal half that forms a dentate process at the middle of the joint, those on the second and seventh less prominent. Mesonotum polished, without trace of parapsidal furrows; depression at base of scutellum broad and rather deep behind. Propodeum short, its horizontal face but little longer than the declivity; basally with an indistinct median carina, but with the basal smooth space very short; elsewhere rugose-reticulate. Propleura smooth. Mesopleura with a small striate area anteriorly near the base of the front coxa and with the lower punctures near its hind margin prolonged into short striæ; metapleura with a very small, smooth space above. Petiole of abdomen wider than long, with a few coarse, irregular ridges above, coarsely striate below; basal striæ on second segment coarse, of equal length, as long as the petiole. Legs stout, longer spur of hind tibia slightly over one half the length of the metatarsus; front and middle tarsal claws with a long, slender appendage at base. Wings hyaline tinged with brownish, cubital and discoidal veins very finely indicated as brownish streaks; stigma moderately broad; radial cell very short, the outer vein entering the costal margin at an angle of about 45°.

One specimen from Woods Hole, Mass., collected by the writer during July, 1902.

Distinguished from *E. ashmeadi* sp. nov., the only other species with dentate antennæ known from the Eastern states, by the simple first flagellar joint. It is quite possibly the male of some described species known only in the female sex, but I cannot associate it with any degree of certainty.

***Exallonyx ashmeadii* new species. (Fig. 14.)**

♂. Length 3.5-4 mm. Black; tegulæ, legs, and base of antennæ honey-yellow; middle and hind coxæ blackish on basal half; antennæ blackish on apical half. Head almost twice as broad as thick, not very much narrowed behind the eyes; ocelli in a flat triangle, the posterior pair as far from one another as from the eye-margin; seen from the side, the eyes are removed from the hind margin of the head by a little less than their width; malar space as long as half the width of the eye, with a delicately impressed furrow, deeper above near the eye. Clypeus with the anterior edge straight; head much narrowed below when seen in front view. Antennæ reaching to the base of the second segment of abdomen; first to sixth flagellar joints each with a carinate process externally, more prominent on the second, third and fourth joints, and very small on the sixth. Scape slightly more than twice as long as thick; flagellar joints gradually decreasing; first three times as long as thick; others in approximately the same proportion except the elongate slender last joint. Mesonotum smooth, much narrowed anteriorly, without trace of furrows; depression at base of scutellum narrow, deep. Propodeum sharply declivous behind, the horizontal portion much longer than the declivity; median carina distinct on horizontal face; smooth areas on each side of carina distinct, half as long as the carina; propodeum elsewhere rugose-reticulate. Pro- and mesopleuræ smooth, the punctures before the posterior edge of the latter not elongated below; metapleura with a round fovea and crescentic smooth space above. Abdominal petiole as broad as long, roughly sculptured above, coarsely striate below; second segment with the basal striæ short, of equal length, the lateral one widened into a broad depression behind. Legs long, rather stout; longer spur of hind tibia half as long as the metatarsus, claws of four anterior tarsi each with a long, stout appendage at base. Wings hyaline without cubital or discoidal streaks; stigma rather broad, radial cell half as long as the stigma, the vein entering the costa at an angle of about 45° .

Type and three other specimens from Machias, Maine, July 20, 1909; a fourth specimen from Eastport, Maine, July 14. All were collected by Mr. C. W. Johnson. Type in the collection of the Boston Society of Natural History.

I believe that this is the form mentioned by Ashmead from the Eastern states as *Proctotrupes californicus* Holmgren. It is distinct from any western form that I have seen.

Exallonyx pleuralis new species. (Fig. 15.)

♂. Length 4.8–5.2 mm. Black; tegulae and legs yellow, the anterior coxae blackish at base and the four posterior ones black except at extreme tips; middle and hind tarsi dark fuscous, except at base; pedicel of antennae rufous. Head fully twice as wide as long, considerably narrowed behind the eyes; ocelli in an equilateral triangle, the posterior pair closer to one another than to the eye-margin; seen from the side the eye is removed by its own width from the posterior margin of the head. Malar space less than half the width of the eye, with a deeply impressed furrow. Head not much narrowed below, the clypeus broad, its margin straight or somewhat concave; front above the antennae with a prominent depression on each side of the intra-antennal carina. Mesonotum sharply narrowed in front, posterior corner of pronotum with a pronounced convex elevation; no trace of parapsidal furrows; depression at base of scutellum deep. Propodeum coarsely rugose-reticulate, more finely so basally, but without any entirely smooth basal areas; median carina very indistinctly defined; in profile the declivity is gradual but rather steep posteriorly. Propleura smooth. Mesopleura with some oblique striae in front of the elevated portion and with a narrow band of longitudinal striae below it; the punctures along its posterior edge not elongated into striae. Metapleura with a shining space above. Petiole of abdomen quadrate, with coarse reticulations above and striae beneath; basal striae on second segment longer than the petiole, of equal length. Legs long and rather slender; longer spur of posterior tibia nearly half as long as the metatarsus; tarsal claws of four anterior legs with a long appendage at base. Wings very slightly tinged with brown; stigma large and broad, radial cell one half as long as the stigma, radial vein meeting the costa at an angle of much more than 45° , second section of radius prolonged downward as a brown streak; discoidal vein, and the cubital less distinctly, indicated as brownish streaks.

Type and two other specimens from Monroe, Wash., May 20, 1908. (A. L. Melander.)

This nice large species is most easily distinguished from related forms by the sculpture of the mesopleura and the absence of processes on the sixth and seventh flagellar joints.

Exallonyx pallidicornis new species. (Fig. 18.)

♂. Length 2.5–3 mm. Black; legs, including coxae, tegulae, palpi, and base of antennae pale brownish yellow; hind coxae at base, hind femora above and hind tarsi infuscated; antennae becoming darker toward apex; mesopleura below piceous. Head fully twice as broad as long, ocelli close together in a flattened triangle; posterior pair a little closer one to another than to the eye-margin. Seen from the side the eye is removed by somewhat less than its width from the posterior margin of the head. Malar space barely as long as half the length of the eye, with an indistinct furrow. Head considerably narrowed below; clypeus with a concave lower margin. Antennae

reaching to the basal third of the petiole of abdomen, all joints simple, cylindrical; scape narrowed basally, twice as long as thick; first joint three times as long as thick, distinctly longer than the second which is two and one half times as long as thick; following gradually growing shorter and thinner; penultimate two and one half times as long as thick. Mesonotum shining, without trace of parapsidal furrows; seen from above the sides of the thorax are concave in front of the tegulæ, due to the concave form of the propleuræ; posterior corners of pronotum not produced into distinct swellings or tubercles. Propodeum rugose with a distinct median carina on its upper face; sharply declivous behind; at the base with a small smooth area on each side which does not extend inward to the median line. Pro- and mesopleuræ entirely smooth; punctures inside the posterior margin of the mesopleura slightly elongated below; metapleura finely rugose, with an extremely small, smooth space above. Petiole of abdomen broader than long, irregularly sculptured above, coarsely striate below; grooves at base of second segment longer than the petiole, of nearly equal length. Legs slightly thickened, especially the posterior femora; longer spur of hind tibia one half as long as the metatarsus; tarsal claws of four anterior legs each with a long, very stout appendage at the base. Wings hyaline, stigma broad, radial cell nearly half as long as the stigma, the radial vein entering the costa at an angle of about 45°; disc of wing without streaks or traces of other veins.

Three specimens, the type from Putman, Conn., July 12, 1905 (H. L. Viereck); others from Wisconsin, October. (W. M. Wheeler.)

***Exallonyx carinatus* sp. nov.** (Fig. 19.)

♂. Length 3.5 mm. Black; antennæ piceous, tegulæ and legs beyond the trochanters fulvous; trochanters, except extreme tip and tarsi, fuscous, anterior coxæ yellowish at tips. Head about one half wider than long, full behind the eyes and then suddenly narrowed; ocelli in a slightly flattened triangle, the posterior ones as far from one another as from the eye-margin. Eyes removed by a little more than their own width from the posterior margin of the head. Malar space as long as half the width of the eye, with a distinct furrow. Head gradually narrowed below, the anterior margin of the clypeus strongly arcuate. Antennæ slender; scape narrow at base, twice as long as thick; flagellar joints simple, first considerably longer than the second, four times as long as thick; second and following decreasing in length, all about three times as long as thick. Thorax strongly narrowed in front, mesonotum smooth, without trace of parapsidal furrows; posterior corners of pronotum rounded, not produced; groove at base of scutellum broad and deep. Pro- and mesopleuræ smooth; the punctures inside the posterior margin of the latter very small above, larger but not elongated below. Propodeum long above, suddenly declivous behind, with a strong carina that is especially prominent on the declivity above and suddenly ends there; above on each side of the carina with a long triangular smooth area covering most of the dorsal face; elsewhere coarsely rugose-reticulate. Metapleura with a rather

large, raised, smooth space above. Abdominal petiole as long as wide, coarsely rugose above, striate below; striæ at base of second segment somewhat longer than the petiole, the lateral ones not so long as the median one. Legs not thickened; longer spur of hind tibia nearly half as long as the metatarsus; appendage at base of four anterior tarsal claws stout, shorter than the claw. Wings slightly tinged with yellowish or brownish; stigma broad, sub-triangular; radial cell one third as long as the stigma, radial vein meeting the costa at an angle of more than 45° ; other veins not indicated as streaks.

One specimen from Oroville, Wash., May 1, 1912 (A. L. Melander).

This species is readily distinguishable by the sculpture of the propodeum in addition to other characters given in the key to species.

Exallonyx parvulus new species. (Fig. 20.)

♂. Length 2-2.5 mm. Black; tegulæ yellowish brown, antennæ piceous, legs yellowish brown, but strongly infuscated on the trochanters and femora, and less strongly so on the tarsi of the four posterior legs. Head about one half broader than long, considerably and evenly narrowed behind; ocelli in a flattened triangle, the posterior pair equidistant from one another and from the eye-margin. Malar space nearly as long as half the width of the eye, with a distinct furrow. Head strongly narrowed below, the margin of the clypeus straight or slightly concave. Eyes sparsely pilose. Antennæ rather short and stout, especially at base; the flagellar joints simple; first three times as long as thick, considerably longer than the second, which is scarcely over twice as long as thick; following imperceptibly shorter and thinner, the penultimate, however, longer than the antepenultimate. Thorax narrowed in front of the tegulæ, its sides distinctly concave. Posterior corners of prothorax convexly elevated; mesonotum smooth without trace of parapsidal furrows. Impression at base of scutellum sharp and deep. Propodeum coarsely reticulate, its posterior face strongly declivous and not much shorter than the dorsal face; median carina distinct to apex, but stronger basally; smooth areas at sides of median carina distinct basally, but gradually passing over to the reticulate sculpture on the sides and behind. Pro- and mesopleuræ smooth; the punctures inside the posterior border of the latter enlarged into short striæ below the middle of the pleura; metapleuræ rugose below, smooth above, but the smooth space not clearly limited. Petiole of abdomen quadrate, irregularly sculptured above, coarsely striate below; grooves at the base of second segment of about equal length, longer than the petiole. Hind legs somewhat thickened; longer spur of hind tibia half as long as the metatarsus; appendage at base of the tarsal claws of the four anterior legs stout at base, as long as the claw. Wings hyaline, stigma narrowly triangular; radial cell nearly half as long as the stigma; radius entering the costa at an angle of less than 45° ; disc of wing without trace of any streaks.

The legs and antennæ vary in some specimens and are often lighter than in the type.

Thirteen specimens from widely scattered localities on the Pacific Coast. Type from Oroville, Wash., April 1. Others from Burton, Wash. (Aug. 19); Vashon, Wash. (Aug. 18, 1910); Chinacum, Wash. (Aug. 23, 1910); Colby, Wash.; Puget Sound, Wash.; Berkeley, Calif. (Aug. 8, 1915); Muir Woods, Calif. (Aug. 7, 1915). All but one were collected and sent me by Prof. A. L. Melander.

This is a small species without any striking peculiarities, but quite distinct as indicated in the key to species.

Exallonyx grandis new species. (Fig. 21.)

♀. Length 8.5 mm. Black; legs except middle and hind coxæ ferruginous; antennæ fuscous, rufous at base; middle coxæ dark rufous, hind coxæ black, except at apex; tegulæ fulvous; palpi brownish yellow. Head seen from above as broad as long, very slightly narrowed behind the eyes; triangularly produced in front of the eyes. In lateral view the eyes are removed from the posterior margin of the head by one and one half times their width. Ocelli in a nearly equilateral triangle, as far from one another as from the eye-margin. Eyes sparsely pilose. Malar space as long as the eye, without trace of any furrow. Clypeus not separated from the face medially, with very deep lateral foveæ, anterior margin straight, with a linear impression along the margin and a lanceolate one just above this. Antennæ of equal thickness throughout the flagellum; scape twice as long as thick; first joint of flagellum five times as long as thick; second three fourths as long; following gradually growing shorter, last only about a fourth longer than the penultimate. Thorax gradually narrowed in front; posterior corners of prothorax not tuberculate or swollen. Scutellar impression deep. Propodeum long, its upper surface gradually curving down to tip, with a strong, complete median carina, with a broad, smooth space on each side of the carina, becoming narrower behind and somewhat tuberculate on the posterior third, rugose-punctate laterally. Pro- and mesopleuræ entirely smooth; line of punctures along hind margin of latter enlarged into short striæ below the middle. Metapleuræ rugose-reticulate, with a small, smooth space above. Petiole of abdomen over twice as long as thick, tubular, but strongly arcuate, being bent up at each end; entirely smooth both above and below; second segment at base with only a median stria which is as long as the petiole; discal cicatrices oblique and lying close to the stria. Femora very stout; longer spur of hind tibia one third as long as the metatarsus. Appendage or tarsal claws of four anterior legs as long and about as stout as the claw. Wings distinctly tinged with brown; stigma narrow, small; radial cell nearly as long as the stigma; the radial vein entering the costa at an angle of about 45°. Cubital and discoidal veins indicated as brown streaks; second section of radius, and first to a less extent, prolonged as brown streaks into the disc of the wing.

One specimen from Ramsey, N. J., August 22, 1909. Type in American Museum of Natural History.

This fine large species is very similar to *E. longiceps* Ashm. in appearance, but is easily distinguished by the petiole of the abdomen being entirely smooth. The petiole is striate in both sexes of *E. longiceps*.

EXPLANATION OF PLATES I AND II.

Fig. 1. *Serphus zabriskiei* new species. *a*, apex of abdomen and ovipositor; *b*, stigma and cell; *c*, base of flagellum of antenna.

Fig. 2. *Serphus sequoiarum* new species. Stigma and cell of wing and base of flagellum of antenna.

Fig. 3. *Serphus cockerelli* new species. Stigma and cell of wing and base of flagellum of antenna.

Fig. 4. *Serphus debilis* new species. Stigma and cell of wing, and base of flagellum of antenna.

Fig. 5. *Cryptoserphus flavipes* Prov. Stigma and cell of wing and base of flagellum of antenna.

Fig. 6. *Cryptoserphus abruptus* Say. Stigma and cell of wing and base of flagellum of antenna.

Fig. 7. *Cryptoserphus occidentalis* new species. Stigma and cell of wing and base of flagellum of antenna.

Fig. 8. *Cryptoserphus melanderi* new species. Stigma and cell of wing and base of flagellum of antenna.

Fig. 9. *Phanoserphus longipes* new species. Stigma and cell of wing and base of flagellum of antenna.

Fig. 10. *Exallonyx angusticeps* Brues. Stigma and cell of wing and flagellum of antenna.

Fig. 11. *Exallonyx similis* new species. Stigma and cell of wing and base of flagellum of antenna.

Fig. 12. *Exallonyx placidus* Brues. Stigma and cell of wing and base of flagellum of antenna.

Fig. 13. *Exallonyx fuscicornis* new species. Stigma and cell of wing and second to sixth joints of flagellum of antenna.

Fig. 14. *Exallonyx ashmeadi* new species. Stigma and cell of wing and base of flagellum of antenna.

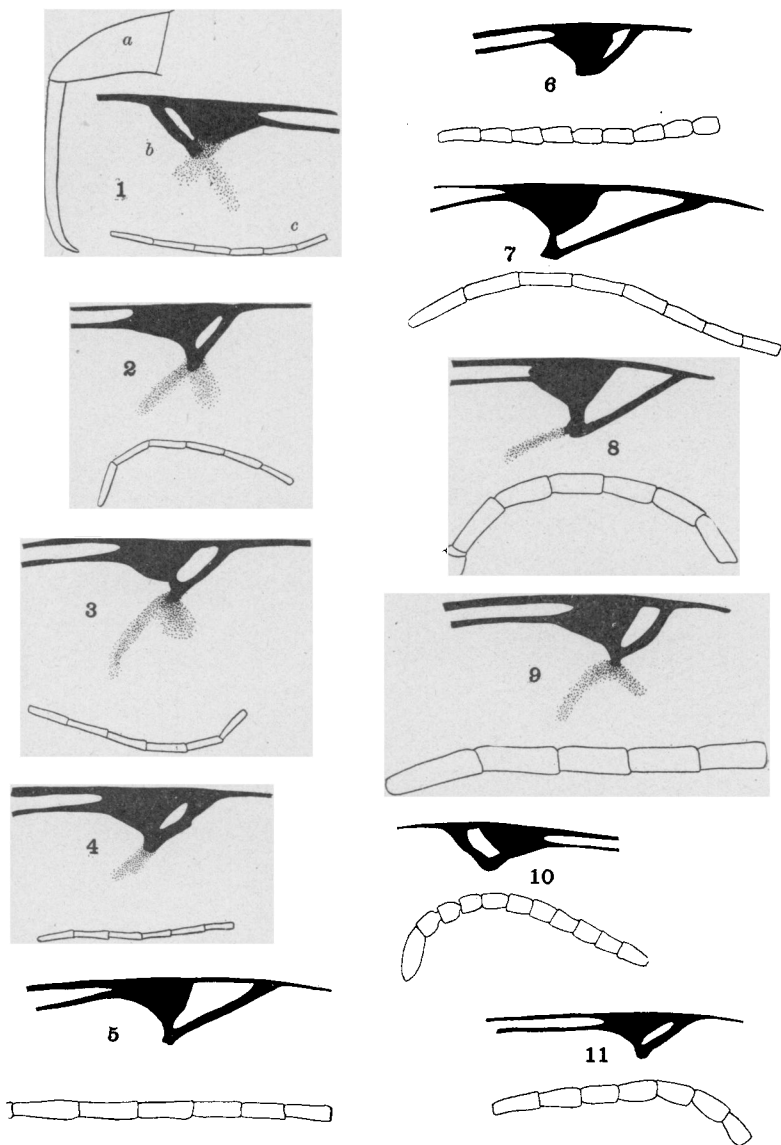
Fig. 15. *Exallonyx pleuralis* new species. Stigma and cell of wing.

Fig. 16. *Exallonyx serricornis* Brues. Stigma and cell of wing and base of flagellum of antenna.

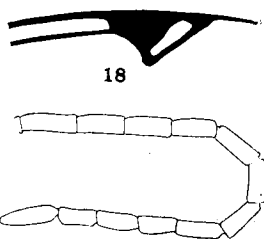
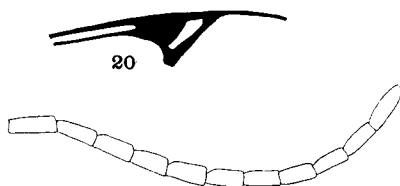
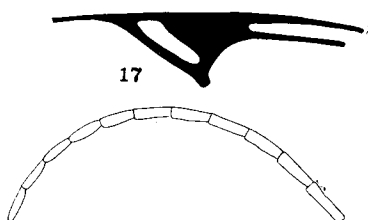
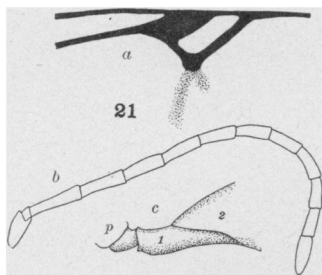
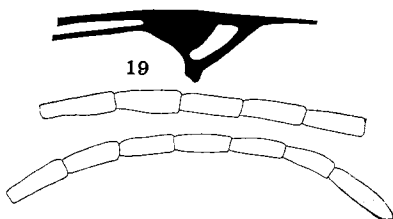
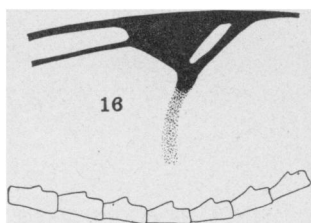
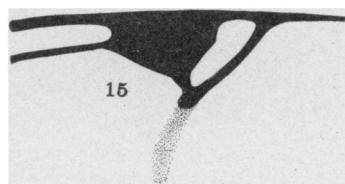
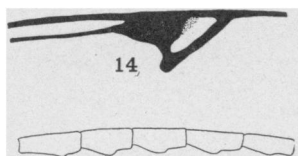
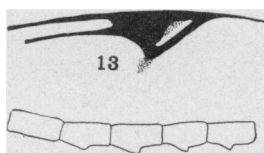
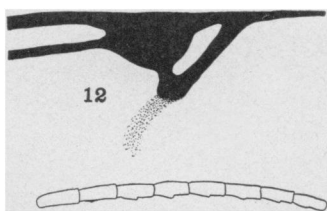
Fig. 17. *Exallonyx simplicior* Brues. Stigma and cell of wing and flagellum of antenna.

Fig. 18. *Exallonyx pallidicornis* new species. Stigma and cell in wing and flagellum of antenna.

Fig. 19. *Exallonyx carinatus* new species. Stigma and cell of wing and flagellum of antenna (first five joints above, last seven below).



Serphidæ.



Serphidæ.

Fig. 20. *Exallonyx parvulus* new species. Stigma and cell in wing and flagellum of antenna.

Fig. 21. *Exallonyx grandis* new species. *a*, stigma and cell of wing; *b*, flagellum of antenna; *c*, petiole of abdomen; (*p*, propodeum; *1*, petiole; *2*, second abdominal segment).

THE RESPIRATORY SYSTEM OF THE CAROLINA LOCUST (*DISSOSTEIRA CAROLINA* LINNE).¹

BY STUART C. VINAL,

AMHERST, MASS.

This paper is one of a series of contributions from the Entomological Laboratory of the Massachusetts Agricultural College, dealing with the anatomy of the grasshopper, *Dissosteira carolina* L. In its preparation I have received much encouragement and assistance from Dr. H. T. Fernald, Dr. G. C. Crampton and Dr. W. S. Regan, and I would take this opportunity of expressing my appreciation of their kindly interest and advice.

HISTORICAL.

Aristotle (about 320 B.C.) propounded the theory that insects did not breathe, and it was not until the time of Malpighi (1669) that it was demonstrated that insects respire by means of internal tracheæ. The studies of Malpighi (1669) on the silk worm, of Swammerdam (1673) on the honey bee, and of Lyonet (1762) on the goat moth paved the way for later investigations, but the famous monograph of Straus-Durckheim (1828) on the anatomy of the cockchafer (*Melolontha vulgaris* L.) in which the tracheal system is treated in great detail, furnishes the basis for all modern work on the subject, such as that of Alt (1912) on the respiratory system of *Dytiscus marginalis* L., etc.

Among the works dealing with the respiratory system of Orthoptera in particular, may be mentioned the investigations of Marcel de Serres (1819) on *Truxalis nasutus*, Leon Dufour (1841) on the

¹ Contribution from the Entomological Laboratory of the Massachusetts Agricultural College, Amherst, Mass. Portion of a thesis for the degree of Master of Science.